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# PROTECTIVE DEVICE FOR THE CONFINEMENT OF EXPLOSIVE OBJECTS OR OBJECTS SUSPECTED OF BEING EXPLOSIVE

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**Protective device for the confinement of explosive objects or objects suspected of being such.**

The present invention relates to a protective device for the confinement of explosive objects or objects suspected of being such.

When an abandoned object is discovered, especially in a public place, the precautionary course of action is to avoid touching it or displacing it and to evacuate people situated all around. Considering the risk of imminent explosion of a suspect object, an attempt is made to confine the suspect object in order to mitigate the effects of a possible explosion.

In order to occur, consideration may be given to covering over the suspect object with a splinter-proof protective cover or hiding the object behind a splinter-proof protective screen.

When an explosive device explodes, a blast effect is propagated in all directions, generating considerable forces upon the obstacles which it encounters. Splinters are also projected in all directions.

In the case of a splinter-proof protective cover, this is lifted up by the explosion so that the splinter-proof cover prevents the upward projection of splinters, without effectively protecting a zone horizontally surrounding the explosive device or preventing the propagation of the blast effect. Moreover, the explosive device covered over by a cover is rendered completely invisible, so that bomb disposal experts who have come to examine the device have a certain apprehension as they free the device in order to examine it, which adds to their stress.

In the case of a screen, this only protects a single side of the explosive device. Upon the explosion, furthermore, there is a risk that the screen will be blasted by the explosion and topple over backward, whereupon it no longer fulfils its protective function.

The subject of the present invention is a protective device for the confinement of explosive objects or objects suspected of being such, which allows an effective protection against a possible explosion of the object by preventing the propagation of splinters and of a blast effect.

The present invention also relates to a protective device which can be easily used without touching a suspect object and which allows easy access to the suspect object for bomb disposal experts, whilst maintaining an improved protection for the latter.

Such a protective device for the confinement of explosive objects or objects suspected of being such comprises a sleeve which is open at its axial ends and comprises at least one layer of fabric of the splinter-proof type, the sleeve being suitable for being placed on a surface by one of its ends, holding itself substantially vertically to surround a suspect object resting on the surface.

When an explosive device placed on a surface explodes, the blast effect and splinters are propagated in all directions, and especially in the horizontal and vertical principal directions. Some splinters and the blast effect are propagated upward. Some splinters and the blast effect head downward, to be reflected by the ground. The protection of people who might be situated close to the explosive device must be effected principally by preventing the propagation of splinters and of the blast effect in the horizontal direction.

The sleeve is designed to be placed vertically surrounding the object without touching it. The open-ended sleeve forms a simple and highly resistant structure in the event of outwardly directed, radial forces applied to the inner wall, so that the sleeve contains the splinters and the blast effect which are propagating radially, that is to say substantially horizontally. The surrounds of the explosive object are protected.

Moreover, the sleeve having an opening on top when placed in position does not prevent the upward propagation of the blast effect and of the splinters, thus allowing an evacuation of the energy of the explosion in a direction which presents no danger to people situated in a zone surrounding the explosive object.

The blast effect and the splinters propagating downward see their energy at least partially absorbed as they are reflected from the ground.

The open-ended sleeve allows bomb disposal experts a view of and access to the object through the top, whilst protecting them from the horizontal propagation of splinters and of the blast effect.

In one embodiment, the sleeve comprises at least one splinter-proof ring, comprising several thicknesses of fabric of the splinter-proof type. The sleeve can comprise a plurality of concentric, splinter-proof rings to increase the protection offered by this sleeve.

In one embodiment, a splinter-proof ring is formed by a winding of fabric of the splinter-proof type and is provided with at least one axial fastening and reinforcing seam. The axial fastening and reinforcing seam allows the splinter-proof ring to be held wound. Furthermore, the fastening and reinforcing seam locally increases the rigidity of the splinter-proof-type fabric used to improve the rigidity of the splinter-proof ring, so that the sleeve can be better held in the vertical position. A splinter-proof ring can be provided with a plurality of axial seams for increasing the resistance of the ring, as well as its strength.

In one embodiment, the sleeve comprises a reinforcing ring comprising at least one layer of material possessing a rigidity sufficient to hold the sleeve upright when it is placed in position. A plastics material, for example, can be used, which has the advantage of being light so as to make the sleeve easier to handle.

In one embodiment, the sleeve comprises at least one reinforcing web surrounding the sleeve. A reinforcing web increases the resistance of the sleeve to the internal forces directed radially outward and generated by the blast effect of an explosion.

In an explosion, in order to prevent a raising of the sleeve from causing a gap to form between the ground and a bottom end of the sleeve, the device can in one embodiment comprise a first sleeve and a second sleeve surrounding the first sleeve, the second sleeve being slidable relative to the first sleeve.

In one embodiment, the first sleeve and the second sleeve are connected by an expansion joint.

In order to prevent the protective rings from being damaged by flames created by an incendiary explosive device, the protective device can be made to comprise an inner protective layer of the fire-resistant type. A fire-resistant lining can be of the type comprising aluminum. For example, a fire-resistant lining can be provided in the form of a fireproofing fabric forming an inner wall of an outer casing of the sleeve.

The present invention and its advantages will become clearer from a study of the detailed description illustrated by the appended drawings, in which:

- figure 1 is a perspective view of a protective device according to the invention;
- figure 2 is a sectional view of an angular portion of the protective device;
- figure 3 is a perspective view of a winding designed to form a protective ring;
- figure 4 is a diagrammatic sectional view of the protective device according to figure 1, so as to illustrate the phenomena which occur with the explosion of an explosive device;
- figure 5 is a perspective view of a variant of the protective device according to figure 1;
- figure 6 is a sectional view of a second variant of the device according to figure 1;

- figure 7 is a sectional view of a device according to figure 6 at the time of an explosion; and
- figure 8 is a detailed view from figure 7.

In figure 1, a protective device for the confinement of explosive objects or objects suspected of being such, referenced 1 in its entirety, appears in the form of a multilayered sleeve 2, having an outer casing 3 provided with an inner wall 4 and with an outer surface 5. The sleeve 2 has openings 6, 7 at its axial ends. Handles 8, here two in number, are fixed on a top edge of the sleeve 2.

The multilayered sleeve 2 comprises concentric layers or rings accommodated in the casing 3. The sleeve 2 comprises, inter alia, splinter-proof rings for preventing the propagation of splinters and of a blast effect, as well as reinforcing rings.

In figure 2, in which the references to the elements similar to those of figure 1 have been retained, a sectional view of an angular portion of the sleeve 2 allows the multilayered assembly of the sleeve 2 to be better visualized.

The concentric layers are described successively from the inside of the sleeve 2 outward. The first layer encountered is the inner wall 4 of the casing 3, which is preferably made of fireproofing fabric or is provided with an aluminum-type fireproofing liner. Next, the sleeve 2 comprises three protective rings 9 disposed concentrically inside the casing 3 and composed of splinter-proof materials, for example of the type used in bullet-proof vests. Next, the sleeve comprises a reinforcing ring 10 made of semi-rigid plastics material, and another protective ring 9, and an outer layer 11 forming the casing 3 with the inner wall 4 and having an outer surface 5. The outer layer 11 can be provided in any material or fabric whatsoever.

In figure 3, a protective ring 9 is formed by a winding of a strip of splinter-proof fabric 12 in order

to obtain a multilayered protective ring 9, here comprising two layers. The strip of splinter-proof fabric 12 is held wound with the aid of an axial fixing and reinforcing seam 13 passing through the different layers of splinter-proof fabric in order to fix those ends of the strip of splinter-proof fabric 11 which are situated radially facing one another. A second fastening and reinforcing seam 14 diametrically opposed to the first seam 12 is provided for improved fastening and reinforcement of the protective ring 9.

A protective ring 9 can comprise any number of layers, according to the protection which is wished to be obtained and the number of different rings which are used. Just one thick protective ring could be provided.

If the sleeve 2 has sufficient strength to be held vertically when placed on one of its axial ends, then there is no need to include a reinforcing ring 10 in the thickness of the sleeve 2.

When an explosive object or device or one suspected of being such is discovered on a surface, urgent action is taken to evacuate a security zone and to confine the object as quickly as possible with the aid of the sleeve 2, taking care, if possible, not to touch it.

In figure 4, or the references to the elements similar to those of figure 1 have been retained, the sleeve 2 has been represented placed on the ground and surrounding an explosive object symbolized by a circle 15.

Upon the explosion of the explosive object 15, a blast effect is propagated in all directions, generating considerable forces upon the obstacles which it encounters. Splinters are also projected in all directions.

With a view to simplifying the explanations, the blast effect is symbolized by arrows representing generated forces. For the sake of simplification, it is considered that the forces are split in the vertical and horizontal directions.

The forces directed vertically upward are symbolized in figure 4 by an arrow $F_{vh}$, the forces directed vertically downward are symbolized by an arrow $F_{vb}$ and the forces directed horizontally are symbolized by the arrows $F_H$.

When one of the forces encounters an obstacle, it pushes it back until the resistance of the obstacle is greater than this force and an opposite reactive force is then created. Each reflection of the blast effect partially absorbs the energy of the explosion. The reflected forces are symbolized by dotted arrows.

In the case of an object 15 placed on the ground, the downwardly directed forces $F_{vb}$ are reflected by the ground, which offers a considerable resistance. The upwardly directed forces $F_{vh}$ escape freely through the top opening 6 made in the sleeve 2.

The horizontal forces $F_H$ provoked by an explosion are propagated radially in a substantially symmetrical manner and strike the inner wall 4 of the sleeve 2. The sleeve 2, composed of fabrics and possibly of a semi-rigid reinforcing ring, has a substantially oval, elliptical or cylindrical shape, which allows the sleeve 2 to effectively resist these radial forces. The semi-rigid sleeve is possibly deformed under the effect of the blast of the explosion so as better to resist the internal forces exerted by the horizontal forces $F_H$.

The protective rings are designed to resist these considerable forces. The sleeve 2 contains the blast effect and the splinters. Consequently, the horizontal forces $F_H$ are reflected inward, whilst being partially absorbed. The successive reflections of the horizontal forces $F_H$ inside the sleeve 2 allow the energy of horizontal propagation created by the explosion to be absorbed and dissipated.

The upwardly directed vertical forces $F_{vh}$, as well as the downwardly directed vertical forces $F_{vb}$ reflected by the ground, are able to escape freely through the top opening 6 formed on the sleeve 2.

The protective device for the confinement of explosive objects or objects suspected of being such can be used inside or outside buildings and uses the resistance of the ground or floor to dissipate a part of the energy produced by the explosion.

In figure 5, in which the references to the elements similar to those of figure 1 have been retained, a sleeve 2 comprises webs 19 surrounding the sleeve 2. The webs 19 allowing the mechanical resistance of the sleeve to be improved in order to contain the blast effect of an explosion.

In figure 6, in which the references to the elements similar to those of figure 1 have been retained, a protective device 1 comprises a first sleeve 2 and a second sleeve 20, less long than the first sleeve 2 and surrounding a bottom end of the first sleeve 2. The second sleeve 20 can slide axially relative to the first sleeve 2.

The second sleeve 20 has a composition similar to that of the first sleeve 2 and comprises, in particular, protective rings (not represented in figure 6).

As illustrated in figure 7, in an explosion the sleeve 2 may be raised in the wake of vertical forces acting upon the inner wall 4 of the first sleeve 2 or in the wake of a reaction force provoked by the downwardly directed vertical forces. In this case, there is a risk of a blast effect being propagated between a bottom edge of the first sleeve 2 and the ground and of splinters being projected horizontally and passing through this space.

In this case, the second sleeve 20, being slidable relative to the first sleeve 2 and not having suffered the direct influence of the explosion, remains unmoved, in contact with the ground. The second sleeve 20 prevents the horizontal propagation of the blast effect and of projected splinters.

In figure 8, an expansion joint 21 connects the bottom edge of the first sleeve 2 and the top edge of

the second sleeve 20. The expansion joint 21, formed for example by an annular skirt or a plurality of tongues, comprises a hem stitched on the outer surface 5 of the first sleeve 2 and an opposite hem stitched on an inner wall 22 of the second sleeve 20.

Preferably, a length of the expansion joint 21 is designed such that, when the first sleeve is displaced relative to the second sleeve to the point of stretching the expansion joint 21, a covering over of the first sleeve 2 by the second sleeve 20 is maintained to prevent the formation of a gap.

The sleeve 2 can be obtained in different sizes according to the size of the explosive device which it is wished to confine. By way of precautions, it might be possible to envisage confining an explosive device by using different-sized sleeves, which are placed successively in a concentric manner to form a plurality of protective barriers or to prevent a horizontal propagation of the blast effect and of splinters if a central sleeve is slightly raised at the moment of the explosion.

The sleeve 2 surrounding the explosive device at the moment of its explosion prevents a horizontal propagation of the splinters, whilst allowing the splinters to be propagated upward or to proceed to strike the ground. The forces created by the blast effect and the splinters propagating vertically will encounter either the ground or floor or a ceiling, which are generally resistant structures which will be able to arrest the blast effect and the splinters without major damage. In addition, the sleeve contains and dissipates the blast effect horizontally, as well as the horizontally projected splinters. The sleeve offers increased protection in the horizontal direction in order to protect the men and installations situated around the explosive device.